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(54) METHOD AND APPARATUS FOR PARALLELISM CONTROL OF THE GRINDING DISCS OF A PULP GRINDER

(71) We, YHTYNEET PAPERITEHTAAT OY JYLHAVAARA, A Finnish Company, of Valkeakoski, Finland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns a method and apparatus for parallelism control of the grinding discs in a pulp grinder.

The quality of groundwood pulp is quite decisively influenced by the degree to which the grinding surfaces are parallel. During operation the temperature of the grinder's frame increases, causing thermal expansion and as a consequence thereof, an error in parallelism. Since the frame is located in the lower part of the grinder, a parallelism error is usually incurred in the vertical plane passing through the axis of the grinding discs. When the grinding faces are no longer parallel, the quality of the pulp deteriorates. An error of only 0.01 mm in the parallelism of the grinding faces is quite significant.

In order to make the grinding faces parallel, a grinder is already known comprising at least one stationary disc and at least one rotating disc which have mutually opposed grinding surfaces, the stationary disc being secured to the grinder's frame by three fixing pins, of which one at least, known as the control pin, is heatable e.g. with the aid of electric current and thus variable as to its length. The grinding surfaces can be made exactly parallel by heating or cooling the control pin.

The functioning of this known apparatus is satisfactory, but its use is encumbered by the fact that it takes an unreasonably long period of time to obtain information as to whether an adjustment of the grinding discs should be undertaken in the first place. This is because the use of the apparatus is based on those results of analysis which are obtained when samples are taken from time to time from the ground pulp and analysed in a laboratory.

In recent times a procedure has gained ever increasing use wherein wood chips are ground to pulp in a semi-dry condition, that is with a dry matter content between 15% and 40%. It is an essential feature of this procedure that between the grinding surfaces a pressure is produced, whereof the greater part, or between 70% and 50%, is due to the pressure of the steam generated between the discs. The rest, or between 30% and 50%, is mechanical pressure. It has been found that even minimal deviations from parallelism of the grinding surfaces cause substantial changes in the quality of the ground pulp. This is caused by the fact that the steam pressure can escape from between the grinding surfaces, whereby the grinding pressure is substantially reduced. It is therefore important to find out much sooner than has been possible heretofore those changes in the quality of the ground pulp which are caused by the grinding discs' deviation from parallelism.

Therefore, the object of the present invention is to provide an improved method for parallelism adjustment or control of the grinding discs of a pulp grinder, and a grinder apparatus for carrying out the method.

It has unexpectedly been observed that the parallelism of the grinding surfaces is reflected with a very high accuracy by the axial force existing between the grinding discs when the other grinding conditions, such as the quantity of ground pulp produced per unit time and the load imposed on the rotating motor, are kept constant. In other words, the grinding discs are parallel when the axial force is at its maximum. This is because then the possibility of escape of the steam generated between

the grinding surfaces is at its minimum.

With the foregoing object in view, the present invention provides a method for adjusting grinding discs so as to be parallel in the grinding of wood chips into ground pulp in a semi-dry condition, that is with a dry matter content of between 15% and 40%. in a grinder comprising at least one stationary grinding disc and at least one rotatable grinding disc, which discs have mutually opposed grinding surfaces, and in which the stationary grinding disc is secured to the frame of the grinder by means of three fixing pins of which at least one is controllably heatable for instance by an electric current so that its length is variable to achieve parallelism between the grinding surfaces of the discs, characterised in that the axial force between the grinding discs is continuously measured and this force is maintained at its maximum by lengthening or shortening the heatable fixing pin.

Thus, the axial force between the grinding discs is continuously measured and this force is maintained at its maximum by lengthening or shortening the heatable fixing pin. The axial force is observable at any time with the aid of simple measuring means. If a reduction in the axial force occurs, this is a sign that the grinding surfaces are not parallel, and it is then necessary to change the length of the heatable fixing pin. Such change of the heatable pin's length may be accomplished by the means disclosed in British Patent No. 1365204.

The invention also provides a grinder apparatus for carrying out the method, comprising at least one stationary grinding disc and at least one rotatable grinding disc mounted on a shaft, which discs have mutually opposed grinding surfaces, and the stationary grinding disc being secured to the frame of the grinder by means of three fixing pins of which at least one is controllably heatable for instance by an electric current so that its length is variable in order to achieve parallelism of the grinding surfaces of the discs, characterised in that means are provided on the shaft of the rotatable grinding disc for measuring the axial force between the grinding discs.

Since the axial force is known every moment, it is a simple matter to automate the operation of the grinder. In a preferred embodiment of the invention the means for measuring the axial force between the grinding discs is connected by means of control automatics with the heatable fixing pin in such a manner that it supplies from time to time, to the heating means of the heatable fixing pins a command to heat or to cool the heatable fixing pin, or to maintain its temperature constant.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is an axial section of a wood pulp grinder;

Fig. 2 is a section along the line II-II in Fig. 1;

Fig. 3 shows graphically the relationship between the axial force between the grinding discs and the temperature of the controllably heatable fixing pin; and

Fig. 4 shows schematically the means for measuring the axial force between the grinding discs.

In Figs. 1 and 2 a wood pulp grinder has been shown, wherein wood chips are supplied axially in the direction of the arrows 1 in between the grinding surfaces 4 and 5 of the grinding discs 2 and 3. The rotatable grinding disc 2 is mounted on a shaft 9 rotated by a drive motor (not shown). The stationary grinding disc 3 is secured to the frame of the grinder by means of three fixing pins 6, 7 and 8. The fixing pin 6 has been made to constitute a control pin which can be controllably heated for instance by electric current so that its length can be varied in order to achieve parallelism between the discs 2 and 3. Since the deviations α from parallelism between the discs usually occur in the vertical plane passing through the axis of the discs, it also usually suffices if the fixing pin 6 lying in this plane is heatable so as to be the control pin. But if required, two pins or even all three may be designed to act as control pins.

When wood chips are process into ground pulp in the semi-dry condition, i.e. with between 15% and 40% dry matter content, steam is generated between the grinding surfaces, and this steam gives rise to the greater part of the pressure between said grinding surfaces. When for one reason or another the grinding discs 2 and 3 deviate from the mutually parallel position, then it is easier for the steam to escape from between the grinding surfaces. Thereby the pressure between the grinding surfaces decreases and the quality of the ground pulp obtained undergoes a change. The lowering of the pressure between the grinding discs can be measured as a decrease of the axial force. To this purpose there are provided on the shaft 9, two flanges 10, between which a strain gauge strip 11 is affixed, as can best be seen from Fig. 4. The strain gauge is electrically connected to slip rings 12, mounted with interposed insulators 13 on the circumference of the flanges 10. The slip rings 12 are in contact with brushes 14, which have been connected to a recording instrument 15. When the axial force on the shaft 9 decreases, the shaft 9 will length. At the same time electrical resistance wires in

the strain gauge 11 are elongated, whereby their resistance increases. This is immediately observable in the indication of the recording instrument 15.

Fig. 3 graphically represents a test series which was carried out in order to find the relationship between the axial force and the temperature of the heatable control pin 6. After starting the grinder, a waiting time was interposed until the machine had gained its normal operating temperature. It was then found that the temperature of the control pin 6 was 100°C. It was further noted that the grinding discs 2 and 3 were exactly parallel. The axial force between the grinding discs was then 7.6 tons. When the control pin 6 was heated by increments, it elongated with a consequent deviation of the grinding surfaces from parallel, also increasing stepwise. The axial force correspondingly decreased as far as 5.2 tons. When subsequently cooling of the control pin 6 was commenced, the grinding surfaces of the discs 2 and 3 once again approached the parallel position, while the axial force simultaneously increased. The maximum of axial force was again reached with the control pin 6 at 100°C, and the grinding discs 2 and 3 were once again parallel.

It is obvious to one skilled in the art that various embodiments of the invention may vary within the scope of the attached claims. For instance, the means for measuring the axial force between the grinding discs may be connected by means of control automatics with the control pin in such a manner that it supplies, from time to time, to the heating means of the control pin a command to heat or to cool the control pin, or to keep its temperature unchanged.

In the drawings only one stationary grinding disc and one rotatable grinding disc have been depicted. However, the procedure of the invention may also be applied in grinders having more than one stationary and one rotating disc.

As means for measuring the axial force means other than that described may also be used. For instance, a pressure transducer is suitable for this purpose.

WHAT WE CLAIM IS:—

1. A method for adjusting grinding discs so as to be parallel in the grinding of wood chips into ground pulp in a semi-dry condition, that is with a dry matter content of between 15% and 40%, in a grinder comprising at least one stationary grinding disc and at least one rotatable grinding disc, and in which the stationary grinding disc is secured to the frame of the grinder by means of three fixing pins of which at least one is controllably heatable for instance by an electric current so that its length is variable to achieve parallelism between the grinding surfaces of the discs, characterised in that the axial force between the grinding discs is continuously measured and this force is maintained at its maximum by lengthening or shortening the heatable fixing pin.

2. A grinder apparatus for carrying out the method of Claim 1, comprising at least one stationary grinding disc and at least one rotatable grinding disc mounted on a shaft, which discs have mutually opposed grinding surfaces, and the stationary grinding disc being secured to the frame of the grinder by means of three fixing pins of which at least one is controllably heatable for instance by an electric current so that its length is variable in order to achieve parallelism of the grinding surfaces of the discs, characterised in that means are provided on the shaft of the rotatable grinding disc for measuring the axial force between the grinding discs.

3. Apparatus as claimed in Claim 2, in which the means for measuring the axial force between the grinding discs is connected by means of control automatics with the heatable fixing pin in such a manner that it supplies, from time to time, to the heating means of the heatable fixing pin a command to heat or to cool the heatable fixing pin, or to maintain its temperature constant.

4. A method for adjusting grinding discs so as to be parallel, substantially as herein described with reference to the accompanying drawings.

5. A grinder apparatus, substantially as herein described with reference to and as illustrated in Figs. 1, 2 and 4 of the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

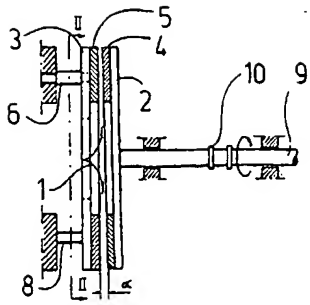

Fig.1

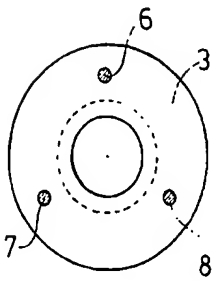

Fig. 2

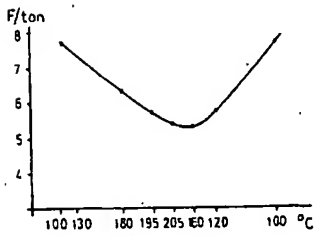

Fig. 3

Fig. 4